Event-Based Control of Simulated Human/Robot Interactions using Parameterized Behavior Trees

MURI ADVISORY COMMITTEE – OCTOBER 21, 2011
Overview

• Background
  • Parameterized Action Representations
  • (Parameterized) Behavior Trees

• PBTs and Event-Centric Control
  • Human/Robot Interactions
  • Functional Virtual Populace

• Future Work
Parameterized Action Representation (PAR)

- Knowledge frame for dictating and specifying agent actions
- Selected from an authored database and instantiated
- Based on a precondition/preparatory-specification system
Background: PARs and PBTs

• What is a Behavior Tree (BT)?
  • Alternative to Finite State Machines (and PaT-Nets)
  • Hierarchical, Goal-Directed, Flexible
  • Two basic rules for success and failure:

Sequence (AND)

Selector (OR)
Parameterized Behavior Trees (PBTs)
- More compact behavior logic than PARs
- All of the advantage of Behavior Trees
- Can parameterize actions through hierarchical lookup nodes
Background: PARs and PBTs

- **Parameterized Behavior Trees (PBTs)**
  - More compact behavior logic than PARs
  - All of the advantage of Behavior Trees
  - Can parameterize actions through hierarchical lookup nodes
  - Can simultaneously control multiple agents
PBTs for Event-Centric Control

- Interactions are managed by Events
  - Agents do not need to directly respond to one another
  - Easy to author collaborative or competitive behaviors
  - Greater author control over interactions
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Functional Virtual Populace

- Coordinate all Agents (Human and Robot) Simultaneously
  - Centralized control structure
  - Macroscopic control over the population behavior
  - Agents still act reactively when not involved in events
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Conclusions and Future Work

• Event-Centric Control
  • Easier to author collaborative behaviors in events than in reactive agents.

• Future Work
  • Planning in the event space
  • Abstracted scenario narrative specification